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(71) Applicant
Dobson Park Industries PLC

(Incorporated in United Kingdom)

14 Fletcher Gate, Nottingham NG1 2PX

(72) Inventor
Richard Ward

(74) Agent and/or Address for Service
Appleyard Lees & Co,
15 Clare Road, Halifax, West Yorkshire HX1 2HY

(54) Power supply with flywheel alternator

(57) The stator output windings 11,12 of a flywheel alternator having a permanent magnet rotor are connected to a load 3 via one or more series capacitors 41,42 which provide a capacitive reactance opposing the inductive reactance of the stator windings so as to regulate the inherently variable voltage which would otherwise appear across the load. The capacitors are chosen so that, at the operating frequency of the alternator, the total capacitive reactance in the stator circuit (including the load) is approximately equal and opposite to the total inductive reactance. The load may be connected via a bridge rectifier (5), (Fig. 3).

The arrangement may provide a portable power supply for temporary traffic lights or power tools.

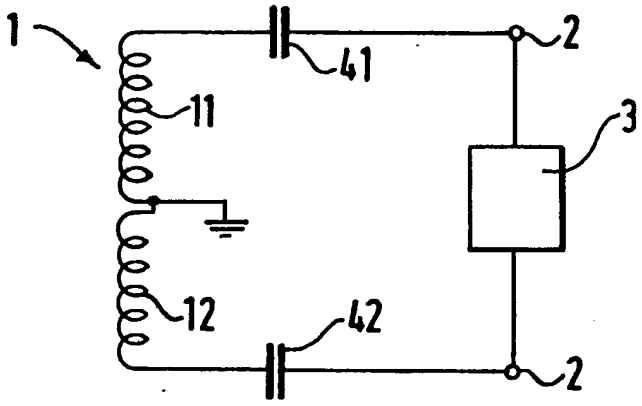

Fig.2.

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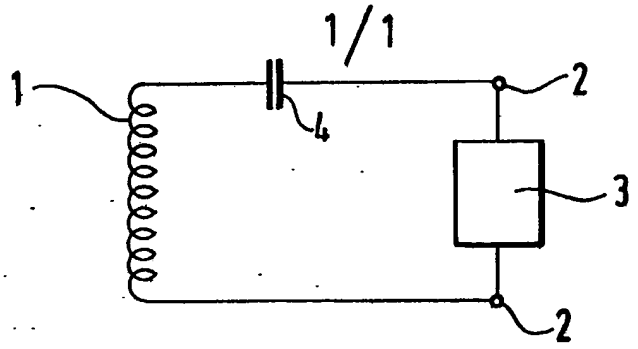

Fig.1

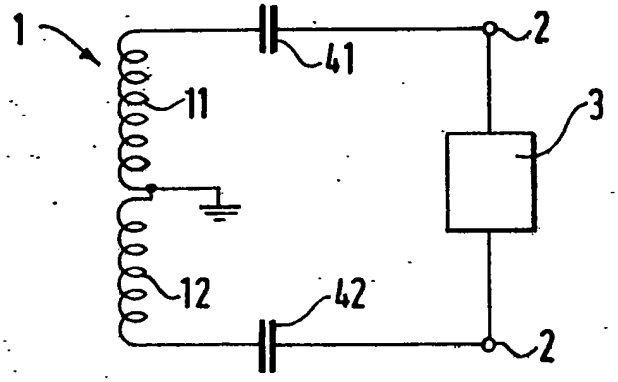

Fig.2.

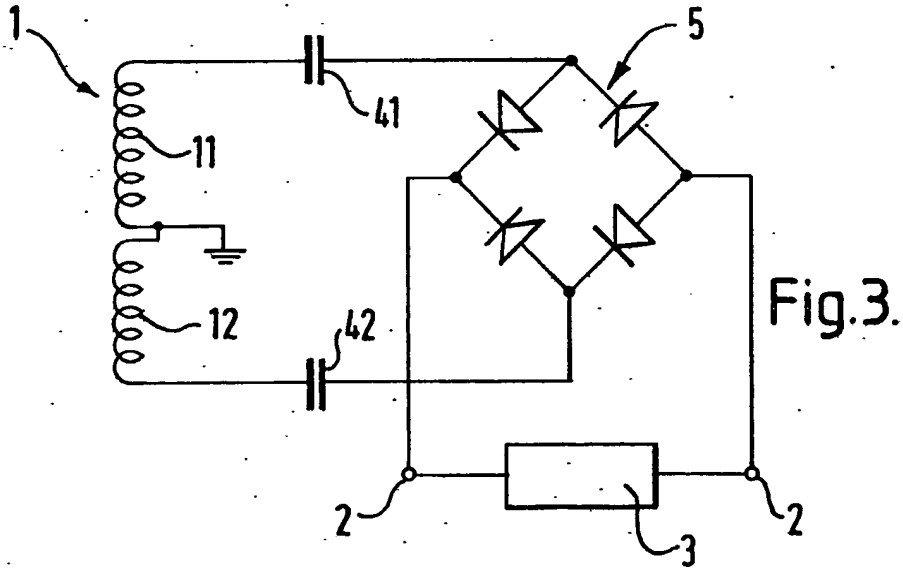

Fig.3.

SPECIFICATION

Flywheel alternators

This invention relates to flywheel alternators.

Usually, flywheel alternators comprise a permanent magnet rotor and a wound stator. See, for example, our co-pending patent application 86 14526 (publication no. 2.....), to which the readers attention is directed.

Flywheel generators are inherently well suited to battery charging. This is because the inductance of the windings, together with field weakening due to armature reaction, combine to limit the charging current to a safe value irrespective of engine speed. The frequency, and therefore the current limiting effect of the winding inductance, rises with the engine speed together with the e.m.f., so that the short circuit current of the alternator is nearly constant over the whole engine speed range, and in a practical case is arranged to be of a value which will not overload the battery charge regulator or the windings.

However, it will be appreciated that, for the very reasons given above, a flywheel alternator is not inherently well suited for use as a power supply, which is generally required to provide a substantially constant voltage from zero to maximum current. Thus, in a flywheel alternator, the effect of the winding inductance is to tend to cause the terminal voltage to fall, as the current increases.

The invention aims to provide flywheel alternators, adapted to be more suitable for use as power supplies.

According to a first aspect of the present invention, there is provided a flywheel alternator comprising a rotor, a wound stator and, in series with the stator windings, a capacitor such that, when a load is connected in series with the stator winding and the capacitor, the capacitive reactance of the capacitor opposes the inductive reactance of the stator winding.

The stator winding may be a tapped winding having a pair of winding legs meeting at a centre tap, a respective said capacitor being provided in series with each winding legs.

The alternator may include rectifier means for rectifying the output from the stator winding.

The invention may be applied with particular advantage, to portable power supplies driven by internal combustion engines—especially, such portable power supplies for traffic lights.

For a better understanding of the invention to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawing, in which:

Figure 1 is a circuit diagram of the stator circuit of a flywheel alternator embodying the present invention;

Figure 2 is a circuit diagram similar to Fig. 1, but showing a centre tap stator winding; and

Figure 3 shows the stator circuit of Fig. 2, provided with rectifying means.

In Fig. 1, the flywheel alternator has a stator winding 1, the output of which appears on terminals 2, across which a load 3 is connected. The load 3 here is substantially resistive, comprising a set of temporary traffic lights, of the type that are commonly used at sites of road works, etc. A capacitor 4 is connected in series with the load 3.

Details of the rotor of the flywheel alternator are not shown, but such constructions are generally quite well known, and a particular advantageous form of construction is shown in our co-pending application 86 14526, to which reference is made above. The rotor of the alternator comprises permanent magnets which are mounted on a flywheel of an internal combustion engine, which serves as a prime mover.

At the present time, portable generators for temporary traffic lights often consist of a single cylinder diesel engine driving a conventional alternator, via belts and pulleys. In contrast to this, the flywheel alternator may be more compact, less liable to damage and immune to belt failure or slip. However, as mentioned above, the inherent properties of a flywheel alternator do not suit it particularly well for use as a power supply, because of the inductance of the stator windings. The value of the capacitor 3 in Fig. 1 is so chosen that, at the operating speed of the alternator, the capacitive reactance afforded by the capacitor 3 is substantially equal and opposite to the inductive reactance of the stator winding 1. Thus, the capacitor 3 serves to regulate the inherently variable voltage which would otherwise appear, as output from the stator winding 1.

The circuit of Fig. 2 is electrically similar to that of Fig. 1. However, it will be noted that in Fig. 2, the stator winding 1 is divided into two legs 11 and 12, meeting at a centre tap 13, which is earthed. A respective capacitor 41 and 42 is placed in series with each leg of the stator winding 1, such that both capacitors 41, 42 are disposed in series with the load 3 appearing across the terminals 2.

The arrangement of Fig. 2 may be utilised by a power supply at 110 volts, but with a maximum voltage at any point in the circuit of 55 volts RMS, due to the centre tap configuration of the stator winding 1.

The arrangements shown in Figs. 1 and 2 may also be utilised where the load 3 has significant capacitive or inductive reactance. In such a case, the value of the capacitor 4 (or 41,42) is so chosen that, at the operating speed of the alternator, the total capacitive reactance in the stator circuit (including the load) is approximately equal and opposite to the total inductive load.

The output from an efficient flywheel alter-

nator tends to be of a significantly higher frequency than usual, for power applications. For example, a 24 pole alternator running at 1500 RPM will provide an output voltage at 300 Hz. Somewhat surprisingly, this has been found to have no appreciable effect on the performance of a traffic light system which is designed to runat 50 Hz.

Thus, it will be appreciated that the systems illustrated in Figs. 1 and 2 can provide a very robust and reliable power supply for temporary traffic lights, whilst being relatively simple and cheap in construction.

We have found that systems as shown in Figs. 1 and 2 may not work satisfactorily with certain loads, such as portable power tools, for example, which have "universal" motors. However, we have found that, by providing a simple rectifier, such power tools with universal motors can be operated quite satisfactorily.

The arrangement shown in Fig. 3 shows the stator circuit of Fig. 2, but with a simple bridge rectifier 5 disposed between the series capacitors 41,42 and the terminals 2 across which the load 3 is provided. We have found that the addition of a bridge rectifier 5 in this way turns the flywheel alternator into a suitable power source for a wide range of tools and appliances driven by universal motors.

Thus, it will be appreciated that, in all of the illustrated embodiments, flywheel alternators, for which technology already exists, can readily be converted for use as reliable power sources, by incorporating a series capacitance in the stator circuit.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification and/or drawings, or to any novel one, or any novel combination, of the steps of any method or process disclosed herein.

CLAIMS

1. A flywheel alternator comprising a rotor, a wound stator and, in series with the stator windings, a capacitor such that, when a load is connected in series with the stator winding and the capacitor, the capacitive reactance of the capacitor opposes the inductive reactance of the stator winding.

2. A flywheel alternator according to Claim 1, wherein the stator winding is a tapped winding having a pair of winding legs meeting at a centre tap, and a respective said capacitor is provided in series with each winding leg.

3. A flywheel alternator according to Claim 1 or 2, including rectifier means for rectifying the output from the stator winding.

4. A flywheel alternator substantially as hereinbefore described with reference to the accompanying drawing.

5. A portable power supply including a flywheel alternator according to Claim 1, 2, 3, or 4.

6. A portable power supply according to Claim 4, including an internal combustion engine as a prime mover for the alternator.

7. A portable road traffic light system, powered by a portable power supply according to Claim 5 or 6.

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